PATENT SPECIFICATION

632,020

Application Date: Jan. 12, 1948. No. 911/48.
Complete Specification Left: Feb. 14, 1949.
Complete Specification Accepted: Nov. 15, 1949.

Index at Acceptance:—Class 35, A2d5.

PROVISIONAL SPECIFICATION

Improvements in or relating to Electric Commutators

We, WATLIFF COMPANY LIMITED, a British Company, of Lombard Road, Morden Road, South Wimbledon, London, S.W.19, and ARTHUR ORBEL HINCHLIFF, a British Subject, of White Lodge, Melville Avenue, South Croydon, in the County of Surrey, do hereby declare the nature of this invention to be as follows:—

This invention relates to electric commutators. In our prior specification No. 11160/46 (not yet published) a commutator is described in which the individual commutator segments have hook shaped teeth formed on their inner surfaces, which teeth are so correlated as to form a succession running helically round and round the commutator axis. Insulating moulding material is injected under heat and pressure into the bore of the segments, and this material keys with the teeth and forms the means for securing the segments into a unit structure.

One of the objects of the helically disposed teeth is to enable a reinforcement for the moulding material, in the form of a helical wire spring, to be employed, such a spring being threaded into the helical succession of gaps between the teeth before the moulding material is injected.

In certain cases where dimensions permit, the present invention proposes to replace the hook shaped teeth by holes punched right through the thickness of the segments. These holes are situated close to the inner surface of the segments and are disposed so that, like the gaps between the teeth in the preceding specification, they form a helical succession extending round and round the axis of the commutator. Thus before the moulding material is injected, the helical wire spring is threaded through the holes in the same as through the gaps between teeth of the preceding specification and when the moulding material is injected it keys with the holes and is reinforced by the spring.

The arrangement will be similar to that described with reference to Figure 15 of said prior specification, except that in the system described in that Figure it was the insulating separators which were provided with holes for the reception of the helical spring, whereas in the present system it is the metal segments themselves which are provided with the holes.

Provision has to be made for the moulding material which is injected into the bore of the assembled segments, to flow through the holes in the segments and thus anchor the segments solidly with the core and at the same time insulate the helical spring.

This is effected by so shaping the metal segments that a channel is formed in a radial direction against one or both sides of each metal segment. Into this radial channel the moulding material can flow and enter the holes in the segments, thus locking the whole assembly together when it sets.

The form of this radial channel is best decided in relation to the actual dimensions of the commutator under construction, but a common and simple form of fairly general application consists in reducing the thickness of the wedge shaped metal segment over the inner portion of its radial depth, forming what is commonly known in the trade as a "tailed bar." When a series of such tailed metal sections is assembled into a circle with appropriate insulating pieces between each segment, the reduced thickness of the tails leaves spaces for the radial flow of moulding material from the bore of the assembly. As the before mentioned anchoring holes are punched through these thin tail portions of the metal segments, the moulding material flows into them also.

Alternatively, the metal section may be of the usual V or wedge shape, and to form flow channels into the anchoring holes, the insulating separator is made narrower than the radial width of the metal section. As the separator is assembled in the outermost radial position, a space is left between the inner portions of the sides of each pair of metal segments and into this the moulding material flows and fills up the anchorage holes.

A fundamental difficulty of the proposed construction consists in centering the helical spring wire reinforcement in the anchoring

Price 2/-

Price 75p

holes, or otherwise preventing it from contacting and electrically short circuiting the metal segments. In specification No. 11160/46 this is done either by an insulating coating on the spring wire or as shown in Figure 15 therein by spacing and holding the spring in holes punched in the insulating separator.

In this present embodiment of the invention the spacing and centering of the spring is performed by appropriate notches punched along the inner edge of the insulating separator at the same pitch spacing as the turns of the helical spring. Upon assembly of the series of metal segments and insulating separators into a circle, the said notches on the separators engage the turns of the spring and centre them in the anchoring holes in the metal segments. When such an assembly is radially compressed in the usual manner of commutator assemblies, the helical spring is firmly located by the notches in the separators, and it cannot be displaced by the viscous high pressure flow of the moulding material when injected.

In this manner the assembly of metal segments is securely anchored to the central core, and due to the interpenetration of the helical wire spring through each metal segment, the whole assembly is strongly held against centrifugal forces in the finished commutator.

For some dimensional sizes of commutators this now proposed construction is simpler to carry out than those proposed in specification No. 11160/46 and its strength can be made at least equally as good and in some cases better than the prior specification.

The radial channels formed by a tailed bar as described can be dispensed with by cutting radial slots in the inner edge of the metal segment. These slots are of less width than the diameter of the anchoring holes into which they enter, and such slots form a channel for the moulding material to flow into the anchoring holes. The anchoring teeth then take the hooked shape similar to that described and covered by specification No. 11160/46.

Dated this 12th day of January, 1948.

A. A. THORNTON & CO.,
Chartered Patent Agents,
Napier House, 24-27, High Holborn,
London, W.C.1.
For the Applicants.

COMPLETE SPECIFICATION

Improvements in or relating to Electric Commutators

We, WATLIFF COMPANY LIMITED, a British Company, of Lombard Road, Morden Road, South Wimbledon, London, S.W.19, and ARTHUR ORBEL HINCHLIFF, a British Subject, of White Lodge, Melville Avenue, South Croydon, in the County of Surrey, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

This invention relates to electric commutators. In our prior specification No. 11160/46 (Serial No. 624,859) a number of commutators are particularly described in which the individual commutator segments have hook shaped teeth formed on their inner surfaces, which teeth are so correlated as to form a succession running helically round and round the commutator axis. Insulating moulding material is injected under heat and pressure into the bore of the segments, and this material keys with the teeth and forms the means for securing the segments into unit structure.

One of the objects of the helically disposed teeth in these commutators is to enable a reinforcement for the moulding material, in the form of a helical wire spring, to be employed, such a spring being threaded into the helical succession of gaps between the teeth before the moulding material is injected.

In certain cases where dimensions permit, the present invention proposes to replace the hook shaped teeth in these commutators by holes punched right through the thickness of the segments. These holes are situated close to the inner surface of the segments and are disposed so that, like the gaps between the teeth in the commutators above referred to, they form a helical succession extending round and round the axis of the commutator. Thus before the moulding material is injected, the helical wire spring is threaded through the holes in the same way as through the gaps between teeth of the commutators above referred to and when the moulding material is injected it keys with the holes and is reinforced by the spring.

In order that the invention may be more clearly understood certain commutators in accordance therewith will now be described, reference being made to the accompanying drawings wherein:—

Figure 1 is an elevational view of a commutator segment,

Figure 2 is a cross section of the same on line II—II of Figure 1,

Figure 3 is a similar view of a corresponding insulating strip for insulating the segments from each other,

Figure 4 is an end elevation, shown partly in section, of a commutator comprising

segments like that of Figures 1 and 2 and insulating strips like that Figure 3,

Figure 5 is a section on line V—V of Figure 4,

Figure 6 is an end view of a somewhat different commutator comprising segments like that of Figures 1 and 2 and insulating strips like that of Figure 3,

Figure 7 is a side elevation of the commutator of Figure 6 taken in section on line VII—VII of Figure 6,

Figure 8 is a fragment of a sectional end view of a commutator which may be the same as either of those of the preceding figures except for a difference in the form of the segments.

Referring to Figures 1 to 7 the two commutators illustrated therein comprises copper segments 1 each of which has a straight row of holes 2 formed through it fairly close and parallel to its inner edge. These holes are arranged so that when the segments 1 are in their assembled relation so as to assume the form of a tube, as in Figures 4, 5 and 6, 7, the holes 2 of them all lie in a helical line running round and round said tube, the pitch of the helix being the distance between any two adjacent holes of any segment. A helical spring 3 of high tensile steel wire is threaded through the helical series of holes 2, and, between the segments 1, insulating strips 4 are provided each of which is formed, at its inner edge with notches 5 which engage the turns of said helical spring. In other words the notches 5 of the insulating strips 4 lie in the same helical line as the holes 2 in the segments 1. The notches 5 of the insulating strips 4 are formed to fit closely on the turns of the spring 3, and they serve to locate the spring so that it cannot make contact with the edges of the holes 2 in the segments 1. Finally the inner portions of the segments 1 are embedded in a body 6 of insulating moulding material, and this fills the holes 2 in the segments 1 and accordingly embeds the turns of the spring 3 and the inner edges of the insulating strips 4.

The segments 1 are now fully united by the moulding material 6, a strong anchorage being constituted by the fact that the moulding material fills the holes 2. The segments 1 are insulated from each other by means of the insulating strips 4, and are fully insulated from the helical spring 3 by the moulding material within the holes 2. At the same time the helical spring 3 forms a strong reinforcement for the moulding material 6.

In the commutator of Figures 4 and 5, the moulding material 6 assumes the usual form of a cylinder with a central bore and the central bore is lined with a metal sleeve 7 adapted to be mounted on the shaft of the electrical machine to which the commutator is to be applied.

In the commutators of Figure 6 and 7, however, said moulding material 6 is given the form of a tube having a relatively thin wall, and said tube has moulded integral with it, say three lugs or fins 8 extending radially inwards from it, at equal angular intervals and in its mid transverse plane. To complete the commutator these lugs or fins 8 are bolted respectively to three lugs or fins 9 which extend radially outwards from a metal tube or sleeve 10 which is coaxially within the said tube constituted by the moulding material. This metal sleeve 10 is to be mounted on the shaft of the electrical machine to which the commutator is to be fitted.

It will now be seen that a commutator is constituted whose segments 1 are embedded in an outer tube of insulating material 6, which outer tube is secured in spaced relation to a coaxial inner sleeve 10 of metal by means of lugs or fins 8, 9 bolted together to form what are virtually spokes. The outer tube of insulating material 6 is strongly reinforced by means of the helical spring 3, and, it will be seen that the assembly is both light and cool, air having free access between the tube of insulating material 6 and the metal sleeve 10.

The lugs or fins 8 have their inner edges arcuate so as to fit accurately on the surface of the metal sleeve 10. The lugs or fins 9 are bolted flush to the side of the lugs or fins 8 by means of bolts 11 and nuts 12, spring plates 13 and washers 14 being provided between the nuts 12 and the surfaces of the lugs or fins 8.

In the construction of both embodiments, the copper segments 1, drilled with the holes 2, are initially identical and somewhat longer than they will ultimately be. The notched insulating (say micanite) strips 4 are also initially identical and longer than they will ultimately be. The segments 1 are first assembled in light rubber bands and the spring 3 is then threaded through the holes 2. The insulating strips 4 are then inserted between the segments one by one and pushed down until their notches 5 register with the turns of the spring 3. The segments 1 are then adjusted endwise until their ends line up correctly with the ends of the adjacent insulating strips 4, and the turns of the spring 3 should now be central in the holes 2. Radial compression is now applied to the assembly, all insulating strips 4 being brought flush with the outside diameter of the assembly. Next the ends of the assembly are machined square.

The assembly is then transferred to the mould, and the moulding operation is effected. In the case of Figures 6 and 7 the inner

arcuate edges of the lugs or fins 8 are ground true, and the metal sleeve 10 is then secured in place. Finally in both embodiments the outer surface of the segments 1 is turned down accurately.

Provision has to be made for the moulding material to flow through the holes 2 in the segments and thus anchor the segments solidly with the core and at the same time insulate the helical spring.

This is accomplished by so shaping the metal segments 1 that a channel is formed in a radial direction against one or both sides of each metal segment. Into this radial channel the moulding material can flow and enter the holes 2 in the segments, thus locking the whole assembly together when it sets.

The form of this radial channel is best decided in relation to the actual dimensions of the commutator under construction, but a common and simple form of fairly general application consists in reducing the thickness of the wedge shaped metal segment 1 over the inner portion of its radial depth, forming what is commonly known in the trade as a "tailed bar" as clearly shown in Figures 1 and 2. When a series of such tailed metal segments is assembled into a circle with appropriate insulating pieces 4 between each segment, the reduced thickness of the tails leaves spaces for the radial flow of moulding material.

Alternatively, as shown in Figure 8, the metal segments 1 may be of the usual V or wedge shape throughout, and, to form flow channels into the anchoring holes 2, the insulating separators 4 are made sufficiently narrower radially than the segments, to ensure that a sufficient space is left between the inner portions of the sides of each pair of segments to enable the moulding material to flow into and fill up the anchorage holes 2.

The reinforcement of the moulding material by means of the wire spring is particularly satisfactory in taking care of length expansions, since the changes in segment length result in such small longitudinal movements of the coils of the spring as to be of no restrictive effect. As the numbers of turns of spring is proportional to length of segment, this holds good for all lengths. The moulding material should have a coefficient of expansion roughly equal to that of copper, and its elasticity should be as high as possible.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A commutator wherein the inner portions of the segments are formed with holes so correlated as to extend in succession helically around the commutator axis, and said segments are secured together by means of insulating moulding material which flows into said holes.

2. A commutator according to claim 1, wherein helical wire reinforcement is embedded in the moulding material and passes through the helical succession of holes.

3. A commutator according to claim 2, wherein the insulating separators are provided between adjacent segments and said separators have apertures which lie in the same helical path as the holes in the segments and which engage with the turns of the helical wire reinforcement and thereby locate the latter with respect to the segments and prevent contact between said wire reinforcement and the edges of the holes in said segments.

4. A commutator according to claim 3, wherein the apertures in the separators take the form of notches in the inner edges of said separators.

5. A commutator according to any of the preceding claims, wherein the segments are formed with their inner portions thinner than their outer portions, the holes being formed in said inner portions, so that spaces are formed between said inner portions facilitating the flow of the moulding material into said holes.

6. A commutator according to claim 4, wherein the segments are wedge shaped throughout, and the separators are made sufficiently narrower (radially) than the segments to ensure sufficient space between the inner portions of the segments to enable the moulding material to flow into the holes.

7. A commutator according to any of the preceding claims, wherein the insulating moulding material is secured to an inner metal sleeve whereby the commutator is adapted to be mounted on a shaft, the securement being effected, not by moulding, but by other mechanical securing means, after the moulding material is set.

8. A commutator according to claim 7, wherein the means for securing said moulding material to said sleeve are such as to provide cooling spaces between the main body of the moulding material and said sleeve.

9. A commutator according to claim 8, wherein said main body of moulding material is of tubular form, and the means coupling said main body and said metal sleeve are of relatively small dimension axially and are interrupted by through spaces at circumferential intervals.

10. A commutator according to claim 9, wherein said means coupling said main body and said metal sleeve comprise lugs extending inwardly from said main body and forming part of the same moulding as said main body, lugs extending outwardly

from said sleeve and means securing said former lugs to said latter lugs.

11. A commutator according to claim 10, wherein the inner end surfaces of said former lugs are of arcuate form and fit closely to the surface of said sleeve.

12. A method of making a commutator according to claim 4 or any of the preceding claims appendant to claim 4, according to which the segments, which are of identical length, are first assembled, and the helical wire reinforcement is threaded through the holes in said segments, subsequently the insulating separators, which are of the same length as the segments, are inserted between the segments until their notches register with the turns of the spring, subsequently the segments are adjusted endwise until their ends line up correctly with the ends of the adjacent insulators and subsequently the moulding operation is effected.

13. A method according to claim 12, wherein after the endwise adjustment of the segments and before the moulding operation, the ends of the assembly of segments and separators are machined square.

14. A commutator substantially as herein described with reference to the accompanying drawings.

15. A method of making a commutator substantially as herein described with reference to the accompanying drawings.

Dated this 14th day of February, 1949.

A. A. THORNTON & CO.,
Chartered Patent Agents,
Napier House, 24-27, High Holborn,
London, W.C.1.
For the Applicants.

Printed for His Majesty's Stationery Office by Dean & Co. (Stockport) Ltd., Stockport and London. 39-221-0-1949
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 2s. 0d. each (inland), 2s. 1d. (abroad), may be obtained.

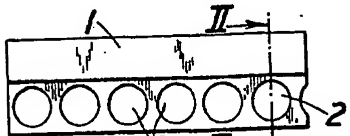

Fig 1

Fig.2.

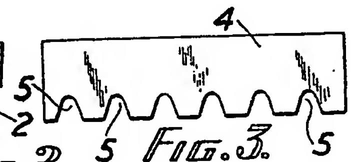

Fig.3.

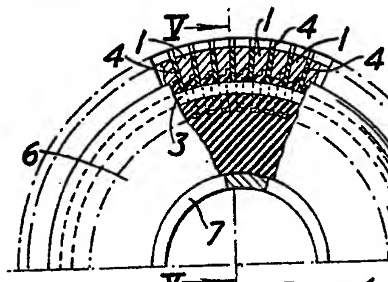

Fig 4

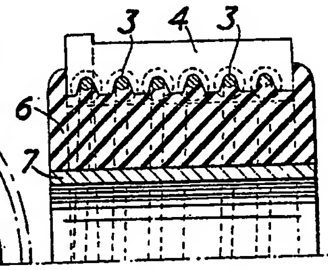

Fig.5.

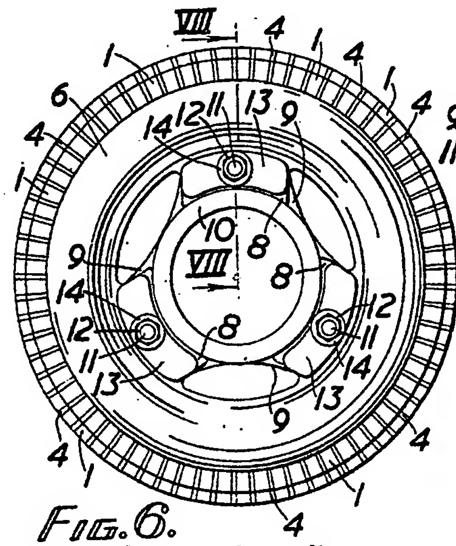

Fig.6.

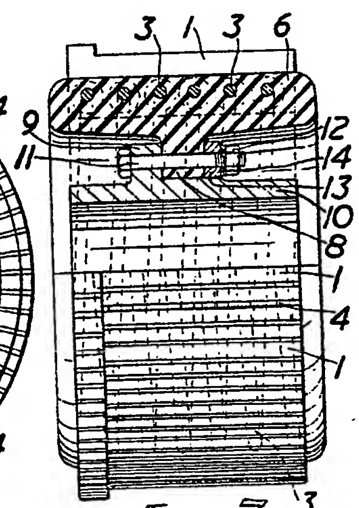

Fig.7.

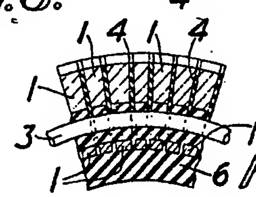

Fig.8.

[This Drawing is a reproduction of the Original on a reduced scale.]